CLAIMS

What is claimed is:

1. A micromachined device for thermal processing at least one fluid stream, the micromachined device comprising at least one fluid conducting tube, wherein at least a region of the fluid conducting tube has a wall thickness of less than 50 μm.

2. The micromachined device of claim 1, wherein the fluid conducting tube provides an inlet portion, an outlet portion and an intermediate portion intermediate the inlet portion and the outlet portion.

3. The micromachined device of claim 1, wherein the fluid conducting tube comprises silicon nitride.

4. The micromachined device of claim 1, wherein at least a region of the fluid conducting tube has a wall thickness less than 5 μm.

5. The micromachined device of claim 1, wherein at least a region of the fluid conducting tube has a wall thickness of 0.1-3 μm.

6. The micromachined device of claim 1, wherein the micromachined device includes at least one inlet portion for introducing a fluid into the fluid conducting tube.

7. The micromachined device of claim 1, wherein the micromachined device includes at least one outlet portion for conducting a fluid from the fluid conducting tube.

8. The micromachined device of claim 1, wherein the fluid conducting tube has a stress-relieving shape.

9. The micromachined device of claim 1, wherein the fluid conducting tube is generally U-shaped.

10. The micromachined device of claim 1, wherein at least one post is disposed within the fluid conducting tube.

11. The micromachined device of claim 10, wherein the post comprises a catalyst.

12. The micromachined device of claim 1, wherein at least one static fluidic mixing structure is disposed within the fluid conducting tube.

13. The micromachined device of claim 1, wherein at least one passive fluidic stop valve is disposed within the fluid conducting tube.

14. The micromachined device of claim 2, further comprising a substrate and wherein the fluid conducting tube includes one or more regions of the inlet and outlet portions disposed in the substrate.

15. The micromachined device of claim 1, wherein a catalyst is disposed within the fluid conducting tube.

16. The micromachined device of claim 2, wherein a catalyst is disposed within the intermediate portion of the fluid conducting tube.

17. The micromachined device of claim 1, further comprising a sensor.

18. The micromachined device of claim 1, further comprising an actuator.

19. The micromachined device of claim 1, further comprising a substrate defining a sealed cavity, wherein substantial portions of the fluid conducting tube are mounted within the sealed cavity.

20. The micromachined device of claim 1, further comprising a thermoelectric device.

21. The micromachined device of claim 1, wherein the micromachined device is a component of a thermophotovoltaic device.

22. The micromachined device of claim 1, wherein the micromachined device is a component of a portable power generator.

23. The micromachined device of claim 1, wherein the micromachined device is a refrigeration device.

24. A micromachined device for processing at least one fluid stream, the micromachined device comprising:

at least one fluid conducting tube; and

at least one thermally conductive structure in thermal communication with a first thermally insulating portion of the fluid conducting tube and a second thermally insulating portion of the fluid conducting tube.

25. The micromachined device of claim 24, wherein the first thermally insulating portion of the fluid conducting tube is an inlet portion and the second thermally insulating portion of the fluid conducting tube is an outlet portion.

26. The micromachined device of claim 24, wherein the thermally conductive structure comprises silicon.

27. The micromachined device of claim 24, wherein at least a region of the fluid conducting tube has a wall thickness of less than 50 μm.

28. The micromachined device of claim 24, wherein at least a region of the fluid conducting tube has a wall thickness of less than 5 μm.

29. The micromachined device of claim 24, wherein at least a region of the fluid conducting tube has a wall thickness of 0.1-3 μm.

30. The micromachined device of claim 24, wherein at least one post is disposed within the fluid conducting tube.

31. The micromachined device of claim 24, wherein the fluid conducting tube has a stress-relieving shape.

32. The micromachined device of claim 24, wherein a catalyst is disposed within the fluid conducting tube.

33. The micromachined device of claim 25, further comprising a substrate defining a sealed cavity, at least a region of the inlet portion and at least a

region of the outlet portion disposed in the substrate, and wherein substantial portions of the fluid conducting tube are mounted within the sealed cavity.

34. A micromachined device for processing at least two fluid streams, the micromachined device comprising:

a first fluid conducting tube;

a second fluid conducting tube; and

at least one thermally conductive structure in thermal communication with a thermally insulating portion of the first fluid conducting tube and a thermally insulating portion of the second fluid conducting tube.

35. The micromachined device of claim 34, wherein at least a region of at least one of the first fluid conducting tube and the second fluid conducting tube has a wall thickness of less than 50 μm.

36. The micromachined device of claim 34, wherein at least a region of at least one of the first fluid conducting tube and the second fluid conducting tube has a wall thickness of less than 5 μm.

37. The micromachined device of claim 34, wherein at least a region of at least one of the first fluid conducting tube and the second fluid conducting tube has a wall thickness of 0.1-3 μm.

38. A micromachined device for processing at least one fluid stream, the micromachined device comprising:

a thermally conductive region; and

at least one fluid conducting tube with at least one thermally insulating portion, at least a portion of the fluid conducting tube disposed within the thermally conductive region.

39. The micromachined device of claim 38, wherein at least one post is disposed within the portion of the fluid conducting tube disposed within the thermally conductive region.

40. The micromachined device of claim 39, wherein the posts are thermally conductive.

41. The micromachined device of claim 38, wherein the thermally conductive region is substantially isothermal during operation of the micromachined device.

42. The micromachined device of claim 38, wherein the thermally conductive region comprises silicon.

43. The micromachined device of claim 38, wherein the portion of the fluid conducting tube disposed within the thermally conductive region is encased within the thermally conductive region.

44. The micromachined device of claim 38, wherein at least a region of at least one of the first fluid conducting tube and the second fluid conducting tube has a wall thickness of less than 50 µm.

45. The micromachined device of claim 38, wherein at least a region of at least one of the first fluid conducting tube and the second fluid conducting tube has a wall thickness of less than 5 µm.

46. The micromachined device of claim 38, wherein at least a region of at least one of the first fluid conducting tube and the second fluid conducting tube has a wall thickness of 0.1-3 µm.

47. The micromachined device of claim 38, wherein at least one post is disposed within at least one fluid conducting tube.

48. A method for processing at least one fluid stream, the method comprising:

providing a micromachined device including

at least one fluid conducting tube having a thermally insulating inlet portion, and a thermally insulating outlet portion, and

at least one thermally conductive structure in thermal communication with the inlet portion and the outlet portion;

introducing a stream of at least one fluid into the inlet portion of the fluid conducting tube;

processing the fluid stream within the fluid conducting tube; and conducting thermal energy between the inlet portion and the outlet portion through the thermally conductive structure.

49. The method of claim 48, wherein the micromachined device further comprises a thermally conductive region, at least a portion of the fluid conducting tube disposed within the thermally conductive region.

50. The method of claim 48, wherein at least one fluid reacts within the fluid conducting tube to produce at least two fluid reaction products, the fluid comprising ammonia and the fluid reaction products comprising hydrogen and nitrogen.

51. The method of claim 48, wherein at least two fluids react within the fluid conducting tube to produce at least two fluid reaction products, the fluids

comprising methanol and water and the fluid reaction products comprising carbon dioxide and hydrogen.

52. The method of claim 48, wherein at least two fluids react within the fluid conducting tube to produce at least two fluid reaction products, the fluids comprising air and butane and the fluid reaction products comprising water and carbon dioxide.

53. The method of claim 48, wherein at least two fluids react within the fluid conducting tube to produce at least two fluid reaction products, the fluids comprising air and butane and the fluid reaction products comprising hydrogen and carbon monoxide.

54. The method of claim 49, further comprising:

providing a second fluid conducting tube having an inlet portion, and an outlet portion, at least a portion of the fluid conducting tube disposed within the thermally conductive region;directing at least a portion of the fluid reaction products from the outlet portion of the fluid conducting tube to a fuel cell;

directing at least a portion of fluids exiting the fuel cell to the inlet portion of the second fluid conducting tube; and

reacting the portion of the fluids exiting the fuel cell within the second fluid conducting tube to produce thermal energy and heat the thermally conductive region.

55. The method of claim 48, further comprising providing a catalyst within at least a region of the fluid conducting tubes.

56. A portable power generator comprising:

a micromachined device including

at least one fluid conducting tube, and

at least one thermally conductive structure in thermal communication with a first thermally insulating portion of the fluid conducting tube and a second thermally insulating portion of the fluid conducting tube; and

a fuel cell in fluid communication with the fluid conducting tube.

57. A method for generating power comprising:

providing a micromachined device including

at least one fluid conducting tube, and

at least one thermally conductive structure in thermal communication with a first thermally insulating portion of the fluid conducting tube and a second thermally insulating portion of the

fluid conducting tube; providing a fuel cell in fluid communication with the fluid conducting tube; producing a fuel within the fluid conducting tube; and conveying the fuel to the fuel cell.

58. The method of claim 57, wherein the fuel comprises hydrogen.

59. The method of claim 57, wherein producing a fuel comprises reacting a stream of at least one fluid within the fluid conducting tube to produce at least two fluid reaction products, the fluid comprising ammonia and the fluid reaction products comprising hydrogen and nitrogen.

60. The method of claim 57, wherein producing a fuel comprises reacting a stream of at least two fluids within the fluid conducting tube to produce at least two fluid reaction products, the fluid comprising methanol and water and the fluid reaction products comprising carbon dioxide and hydrogen.

61. The method of claim 57, wherein producing a fuel comprises reacting a stream of at least two fluids within the fluid conducting tube to produce at least two fluid reaction products, the fluid comprising air and butane and the fluid reaction products comprising hydrogen and carbon monoxide.

62. A method for fabricating a device for processing at least one fluid stream, wherein the method comprises:

patterning a substrate to form at least one tube mold having walls accessible to an environment and to form at least one release pit not accessible to the environment;

depositing a thin film to coat the walls of the tube mold; and

removing selected regions of the substrate using a chemical etchant to form at least one fluid conducting tube.

63. The method of claim 62, further comprising defining a wall thickness of at least a region of the fluid conducting tube by controlling a thickness of the thin film deposited on the walls of the tube mold.

64. The method of claim 62, further comprising providing the fluid conducting tube with at least one open end disposed in the substrate.

65. The method of claim 62, wherein the etch results in discontinuous portions of the substrate remaining in thermal communication with the fluid conducting tube.

66. The method of claim 62, wherein removing selected regions of the substrate provides at least one thermally conductive structure from the substrate, the thermally conductive structure in thermal communication

with a thermally insulating first portion of the fluid conducting tube and a thermally insulating second portion of the fluid conducting tube.

67. The method of claim 62, wherein removing selected regions of the substrate provides at least one thermally conductive structure from the substrate, wherein the thermally conductive structure is in thermal communication with a thermally insulating portion of a first fluid conducting tube and a thermally insulating portion of a second fluid conducting tube.

68. The method of claim 62, wherein a portion of the fluid conducting tube remains disposed in an unetched thermally conductive portion of the substrate.

69. The method of claim 62, wherein the device includes posts within the fluid conducting tube.

70. The method of claim 62, wherein the posts comprise substrate material.

71. The method of claim 62, wherein patterning the substrate provides structures within the tube mold that are static fluidic mixing structures in the fluid conducting tube.

72. The method of claim 62, wherein patterning the substrate provides structures within the tube mold that are passive fluidic stop valves in the fluid conducting tube.

73. The micromachined device of claim 1, wherein the fluid conducting tube comprises at least one junction where one tube is connected to at least two tubes.

74. The micromachined device of claim 30, wherein the posts are thermally conductive.

75. The method of claim 57, wherein the fuel comprises hydrogen and carbon monoxide.